IN THE UNITED STATES DISTRICT COURT

FOR THE NORTHERN DISTRICT OF OKLAHOMA

STATE OF OKLAHOMA, ex rel, W.A. DREW EDMONDSON, in his capacity as ATTORNEY GENERAL OF THE STATE OF OKLAHOMA, et al.	)	
Plaintiffs,	)	
V.	)	No. 05-CV-329-GKF-SAJ
TYSON FOODS, INC., et al.,	)	
Defendants.	)	

REPORTER'S TRANSCRIPT OF PROCEEDINGS

FEBRUARY 21, 2008

PRELIMINARY INJUNCTION HEARING

VOLUME III

BEFORE THE HONORABLE GREGORY K. FRIZZELL, Judge

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Exhibit 55

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UNITED STATES COURT REPORTER

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PROCEEDINGS

February 21, 2008

THE COURT: Mr. Bullock, Mr. George, and Ms. Southerland and I spoke a second ago outside the courtroom with regard to evidentiary matters. We've been going at such a rapid pace and because there has been an agreement with regard to exhibits on direct, there have been promises made to the Court with respect to exhibits that have been used on cross that they would be handled at the next break or at lunch that has not been done. So the concern is that going forward, we need to handle this matter very quickly or it presents real

A. Yes, we use the fecal indicator bacteria as a tracer or a surrogate to indicate the risk of the presence of human pathogens and thus the increased risk to human health from exposure to that water.

Q. Now, is it true that some pathogens that are in fecal material can be alive but not be culturable?

A. That's correct. The -- I guess the century old methodology for measuring bacterial concentrations is to culture them on some sort of an auger medium. We've known in the last 20 years or so that many organisms, when they're excreted from their host and they get out into the environment, may not die off, but they may become -- they may die off, but they may also become stressed, physiologically stressed, in which case they can no longer grow on the media that we normally use to culture them or detect them.

And so many studies have shown that when these bacteria become viable, we call this the viable but non-culturable phenomenon. They still have indications of metabolism and of the ability to sustain themselves. They can also be resuscitated or revived and start growing again when they get into a host, so when they get back into an environment that is conducive to their growth. So in spite of the fact that we cannot culture them and detect them, they still are potentially dangerous. And this is known in microbiology as the viable but non-culturable phenomenon. It's been seen in

so drying out. And again, it's very hard to say, it depends on a lot of common conditions that the bacteria encounter. If they are exposed fully to ultraviolet radiation and desiccated, it may take only a matter of hours for them to be permanently inactivated or killed. On the other hand, if they're shielded from radiation, if they're provided with some moisture, then they may persist for up to months at a time.

THE COURT: Thank you. Mr. Page.

MR. PAGE: Thank you, Your Honor.

Q. (By Mr. Page) So those bacteria can remain viable for months at a time if they have certain environmental conditions available?

A. That's correct.

Q. At the same time, if you use a standard method to try to identify that bacteria in the environment, it wouldn't necessarily be culturable?

A. That's correct, because the bacteria may be surviving and persisting in the environment, but they may be stressed to the point where they won't grow on this basically artificial growth substrate that we're providing them.

Q. Now, if a pathogen such as Campylobacter goes into this viable but not culturable state, can it then also remain as a hazard to human health?

A. Yes, studies have shown that viable but non-culturable organisms, when passed into a host such as perhaps if they were

Mr. Page.

MR. PAGE: Thank you, Your Honor.

Q. (By Mr. Page) Dr. Harwood, back to Exhibit 433. This is simply a summary of Oklahoma and U.S. EPA standards as they apply to recreational water quality uses; correct?

A. That is correct.

Q. That's bathing, swimming, splashing in the water; correct?

A. Right, correct.

Q. And I want to make sure this is clear. If someone is in water, bathing or swimming or splashing in the water, and the bacteria, any of those three bacteria, are at or above those levels, what does the EPA say about the expected sickness rate?

A. The EPA's guidelines and epidemiology studies and other epidemiology show that there is an increased risk of illness as levels above those standards rise. And the specific illness upon which most of these studies are based is gastroenteritis, so vomiting, diarrhea, nausea, cramps.

Q. How many people will get sick?

A. If the standards are right at that level, that's expected to be 8 individuals per thousand recreational water users and then it will go up from there. For example, if the E. coli concentrations increase about tenfold from this standard, then it's expected that the chance of getting ill will double.

Q. Thank you, Doctor. Now I'd like to turn your attention to State's Exhibit 434. Again, we have a blow-up on the tripod

consider high risk. And for example, poultry feces contain -- are known to very frequently contain Salmonella and Campylobacter. These are so-called zoonotic pathogens which means that they're inhabitants of the animal gastrointestinal tract but they cause disease in humans. And in fact, Campylobacteriosis and Salmonellosis are among the most prevalent of both waterborne and foodborne diseases.

Q. Both Campylobacter and Salmonella, are they both present in poultry waste?

A. Yes, they are.

Q. What about E. coli, is that also a zoonotic bacteria?

A. Well, the pathogenic forms of E. coli are, such as E. coli 0157:H7R, yes, zoonotic forms as well.

Q. I'd like now to draw your attention to State's Exhibit 437. Dr. Harwood, could you identify this exhibit for the Court, please?

A. Yes, this exhibit is a graph that was prepared from data that was collected in the IRW from 2005 to 2007. And it shows the relationship between E. coli concentrations on the vertical axis and fecal coliform concentrations on the horizontal axis. And what this graph shows is that he relationship between fecal coliforms and E. coli in the vast majority of the IRW samples is nearly equivalent and very linear with a slope of about one. And so these are highly correlated. And with this sort of information then, we can feel comfortable about applying the

Q. Doctor, I want to now refer you to an exhibit that Dr. Teaf referred to a couple of days ago, State's Exhibit 406. Would you please remind us what information is shown on Exhibit 406?

A. This is a map of the Illinois River Watershed. And these various color segments are those that have been designated impaired due to high indicator bacteria levels by the State of Oklahoma. At each of the dots are public access site points along tributaries in the Illinois River itself. And the red dots indicate sites where water quality standards were exceeded by indicator bacteria. So showing that, in fact, people who are using the water, they're putting in at these public access points for, as Dr. Caneday explained, for floating, swimming, canoeing, these people are being exposed to these elevated levels of indicator bacteria and thus at increased risk for illness.

Q. Now, does this information have any importance to you as a microbiologist with regard to evaluating the health risks associated with the Illinois River?

A. Yes, because we know that -- since we know -- so these aren't small ditches that nobody goes in, this is a scenic river. It is used -- it's an Oklahoma scenic river. It's widely used for recreation as was mentioned before. We know that literally thousands of people are being exposed to these high levels of bacteria and the increased health risk that's

represented by them.
Q. Thank you, Doctor. I want to switch gears on you a little bit again. Do you have an opinion with respect to the source of bacteria that has impaired the IRW?
A. Yes, I believe that a significant portion of that is contributed by land applied poultry litter.
Q. And do you have an opinion as to what would happen if poultry waste land application was stopped in the IRW?
A. Yes, I believe that over time the levels of bacteria would decline and that the human health risk would be decreased.
Q. Okay. Do you have any specific evidence, Doctor, that contribution of poultry litter to lands in the IRW has contaminated the waters of the IRW?
A. Yes, we used a reliable method called polymerase chain reaction or PCR to develop a poultry litter specific biomarker which we use as a tracer to follow the pathway of poultry -- of microbial contamination from poultry litter throughout the Illinois River Watershed.
Q. Would you just define briefly what a biomarker is?
A. A biomarker would be a biological component of some organism. In this case it's a bacterium and in this case the biological component is a gene fragment that we were able to detect by PCR and this bacterium is highly associated with chicken -- with contaminated chicken litter.
Q. Doctor, are there differences between the PCR method of

have the questions of fate and transport through the watershed. And we also have the question of there are things that we don't know about the relative rates of transport of pathogens compared to indicator bacteria and indicator bacteria and pathogens compared to the biomarker. So just because we don't detect it doesn't mean that there was never any poultry contamination there.

Q. Does the biomarker have a different life span in the environment than, for example, a chemical?

A. Well, a chemical might be expected to persist indefinitely until it gets used through biogeochemical cycling but because bacteria are biological organisms, they have a certain amount of persistence time in the environment, so they will not persist indefinitely over time.

Q. What type of samples were analyzed with the PCR method?

A. We analyze poultry litter samples. We analyze land applied soil samples or soil samples which received land application of poultry litter. We amplified edge of field samples which are basically direct runoff from fields that had received land application of poultry litter. Surface water samples, including Illinois River samples and tributary samples. And groundwater samples, including geoprobe samples and well samples, and also spring samples.

Q. From the samples you analyzed for litter, what were the results with the PCR marker?

A. All of the litter samples were positive for the biomarker, quantifiable with levels of biomarker over -- up to over a billion copies per gram.

Q. What about the land applied field samples, what were the biomarker results for that?

A. The land applied field samples were about 90 percent positive for the biomarker. And the maximum, around the maximum value for that was 10 million copies per gram.

Q. And what about edge of field, the next step in the path, what about those for biomarker?

A. Edge of field samples, about 50 percent positive and a maximum value of about 10 million per liter.

Q. And the same --

THE COURT: Doctor -- excuse me just a second, Mr. Page. You say you worked with Dr. Olsen with regard to sampling strategy and collection. To the uninitiated such as myself, the first question that jumps to mind as I tried to superimpose the location of the poultry houses to this map is that when we're talking about the area of recreational activity, there don't seem to be as many sampling stations, but rather that sampling is occurring in the area where these poultry houses are located and which raises fate and transport issues. I mean, to the extent that we are really focused here in this case about the public health concerns, it implicates fate and transport of these bacterium from the areas of highest

poultry house location.

Why is it that you and Dr. Olsen didn't select more? I see that you have some green RNA results down here in the area just above Lake Tenkiller showing detectable, but not quantifiable. To the extent that we're focusing here to some extent on recreational activity and the public health repercussions or impact, why is it that you and Dr. Olsen didn't pick those locations as opposed to the locations closer to the poultry houses?

THE WITNESS: That would be -- when we were planning the sampling strategy, the focus was to find the pathway that would start basically at the poultry litter -- or find if there was a pathway that would start at the poultry litter houses and proceed --

THE COURT: From a scientific point of view.

THE WITNESS: Right.

THE COURT: I understand completely, sure.

THE WITNESS: Right. And then so, yeah, and I have to admit that, in fact, if I had looked at this map a couple of months ago, I wouldn't even have known where the important recreational water bodies were. It wasn't something that -- demonstrating that hypothesis in particular wasn't the focus.

THE COURT: You're trying to make the link?

THE WITNESS: Yes, exactly.

THE COURT: Right, I understand. Go ahead, Mr. Page.

MR. PAGE: Thank you, Your Honor.

Q. (By Mr. Page) Did you detect the biomarker in surface water samples?

A. Yes, we did. We detected the biomarker in 43 and a half percent or so of surface samples at levels up to 100,000 per liter.

Q. What about groundwater samples?

A. We did detect it in some groundwater samples, two groundwater samples to be exact, and at a level up to 20,000 per liter. And two out of 22 samples would be 9 percent.

Q. Now, a similar question to what the Judge just asked you. What does this information tell you, if anything, with regard to the distribution or pathway of poultry waste bacteria in the IRW?

A. Well, it demonstrates that the bacteria are following the pathway or that they have a transport pathway from the fields to the surface waters and also into the substratum into that karst, that fractured karst substratum which then allows them to appear in the groundwater and then be transported back upward into the spring systems.

Q. Let me draw your attention or if you would, to sample marked LAL5A on this exhibit. Can you identify that location for the Court, please?

A. Yeah, I think so. LAL5A is right about here. That's a soil sample and from a land applied field. That one had 4

Q. Does that mean the poultry waste biomarker co-varies with the indicator bacteria?
A. Correct.
Q. What is the chance of, let's say, a mistake in this analysis?
A. That would be, again, it's P less than .0001, so less than one in a thousand that this relationship occurred by chance.
Q. Now, Dr. Harwood, earlier I believe you stated an opinion concerning the importance of poultry waste as a contaminant, a bacterial contaminant in the IRW?
A. Correct.
Q. Would you please restate that opinion?
A. Yes, my opinion is that the poultry waste -- land application of poultry waste in the IRW is a major contributor to elevated indicator bacteria loads in the Illinois River Watershed in these waters.
Q. Now, what evidence did you use to reach this conclusion?
A. I used the weight of evidence approach which is what typically one does when investigating ecological questions. So rather than relying on one line of investigation, integrated numerous lines. So that would be starting out with -- and not in any particular order. But since we're talking about it, the widespread and quantifiable presence of the poultry litter biomarker and the evident pathway in terms of its concentration gradient from the litter to the fields to the edge of the field